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MISCELLANEOUS PAPER M-76-1

PRELIMINARY TESTS OF GLOSS-REDUCTION AND COLORING AGENTS FOR CAMOUFLAGE OF POLYVINYL ACETATE DUST-CONTROL FILM

by

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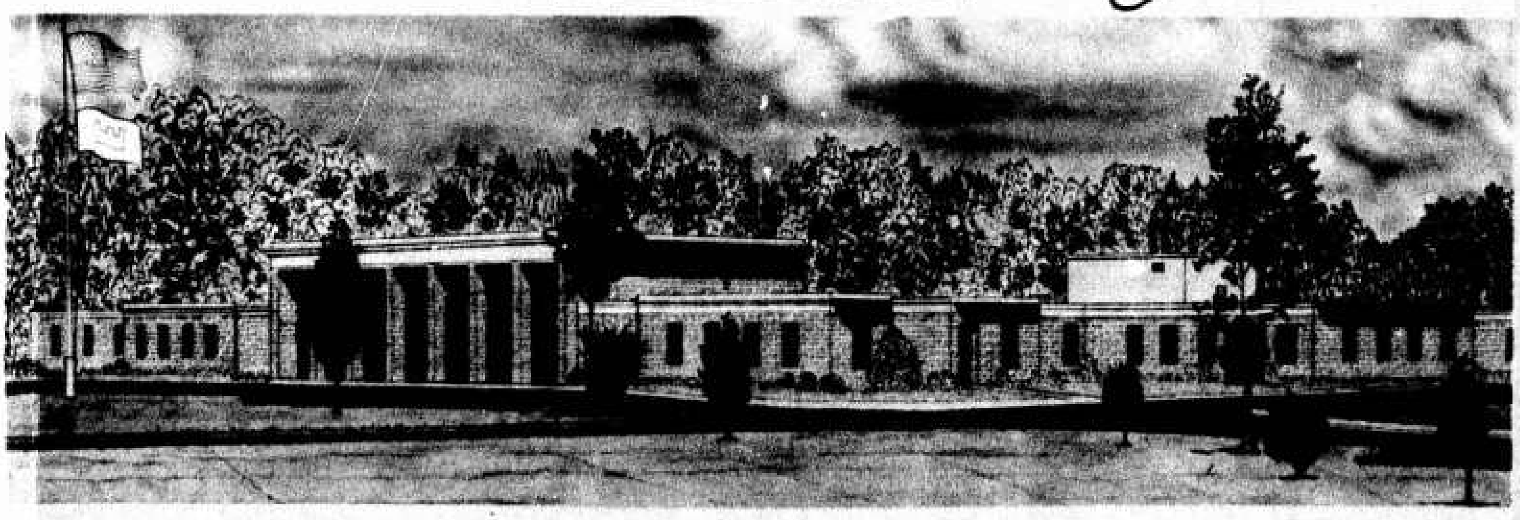
February 1976
Final Report



Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

Under Project 1A762719AT40, Task A3,
Work Unit 1006

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: WES-MP- ~~Miscellaneous Paper~~ M-76-1
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): PRELIMINARY TESTS OF GLOSS-REDUCTION AND COLORING AGENTS FOR CAMOUFLAGE OF POLYVINYL ACETATE DUST-CONTROL FILM.
5. TYPE OF REPORT & PERIOD COVERED: Final report, Jul 74 - Jun 75
6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Clarence R. Styron, III; Eugene E. Addor
8. CONTRACT OR GRANT NUMBER(s): 1-A-762719-AT-40-A-3
9. PERFORMING ORGANIZATION NAME AND ADDRESS: U. S. Army Engineer Waterways Experiment Station, Mobility and Environmental Systems Laboratory, P. O. Box 631, Vicksburg, Miss. 39180
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: DA ~~Project~~ 1A762719AT40, Task A3, ~~Work Unit 1000~~ (former 4A762719AT33)
11. CONTROLLING OFFICE NAME AND ADDRESS: Office, Chief of Engineers, U. S. Army, Washington, D. C. 20314
12. REPORT DATE: February 1976
13. NUMBER OF PAGES: 19
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): 25 p.
15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)
18. SUPPLEMENTARY NOTES
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Camouflage
Coloring agents
Dust control
Gloss reduction
Polyvinyl acetate

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

DCA-1295 is a special polyvinyl acetate (PVA) formulation developed for the U. S. Department of the Army for use as a dust-control surface on expedient airstrips and adjacent service areas. The PVA is sprayed over a fiberglass scrim to form a thin film over the ground surface, and has been field tested and proven effective for its design purpose. However, the PVA film cures to a glossy, highly reflective surface that can be easily detected by enemy surveillance systems, is potentially highly attractive to target-seeking missile guidance devices, and sometimes creates hazardous visibility. (Continued)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

038100

20. ABSTRACT (Continued)

conditions for aircraft landings. The purpose of the work reported herein was to search for possible means for reducing the glossiness of the cured PVA surface, with the possibility for adding camouflage coloration also considered. A formula was found for mixing colored chalk dust (marking chalk powder) with DCA-1295 concentrate to produce an emulsion that can be painted (brushed, rolled, or sprayed) on the cured, in-place PVA film, and that cures to a tough, nonglossy, colored surface. This formulation formed a good bond with the cured film, and in a field test withstood direct sun and weather for 11 months, well beyond the 6-month design life of the film. In addition, this formulation was also applied, with satisfactory results, to a cured DCA-1295 film (without the fiberglass reinforcement) previously spray-coated onto metal landing mat and fiber membrane. None of the experimental substances (various paint flatteners and extenders, dyes, flat latex paint, and coloring powders) produced satisfactory results when admixed directly with the DCA-1295 emulsion for direct application to the fiberglass scrim during initial installation. It is recommended that the camouflage potential of chalk-dust PVA coating be further evaluated, including its effect on infrared and radar signatures, with particular emphasis on its potential use as a camouflage coating for fixed installations. It is also recommended that research be initiated toward developing a chemically compatible deglossing and coloring agent for inclusion in the DCA-1295 emulsion at its initial application.

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Preface

The research reported herein was conducted under former Department of the Army Project 4A762719AT33, "Research for Base Development in the Theater of Operations," Task 02, "Base Development Facilities," Work Unit 002, "Fixed Installation Camouflage Research" (now Project 1A762719AT40, "Mobility, Soils and Weapons Effects," Task A3, "Geoscience Techniques and Methodologies," Work Unit 1006, "State-of-the-Art Survey of Fixed-Installation Camouflage"), sponsored by the Directorate of Military Construction, Office, Chief of Engineers. The study was conducted at the U. S. Army Engineer Waterways Experiment Station (WES) during the period July 1974-June 1975 by personnel of the Soils and Pavements Laboratory under the general supervision of Messrs. J. P. Sale and R. G. Ahlvin, Chief and Assistant Chief, respectively, W. L. McInnis, Chief, Material Development Division, and Royce C. Eaves, Chief, Stabilization Branch, and under the direct supervision of Mr. C. R. Styron III, of the Stabilization Branch. The report was prepared by Mr. Styron, and by Mr. E. E. Addor of the Environmental Systems Division, Mobility and Environmental Systems Laboratory, under the supervision of Messrs. B. O. Benn and W. G. Shockley, Chiefs, respectively, of the latter division and laboratory.

COL G. H. Hilt was Director of WES during the conduct of the study and preparation of the report. Mr. F. R. Brown was Technical Director.

Contents

Conversion Factors, U. S. Customary to Metric (SI) and Metric (SI) to U. S. Customary Units of Measurement

Units of measurement used in this report can be converted as follows:

Multiply	By	To Obtain
U. S. Customary to Metric (SI)		
inches	25.4	millimetres
feet	0.3048	metres
miles per hour (U. S. statute)	1.609344	kilometres per hour
pounds (mass) per square yard	0.542492	kilograms per square metre
Metric (SI) to U. S. Customary		
grams	0.0352740	ounces (mass)

PRELIMINARY TESTS OF GLOSS-REDUCTION AND COLORING AGENTS FOR CAMOUFLAGE OF POLYVINYL ACETATE DUST-CONTROL FILM

Introduction

Background

1. DCA-1295 is a polyvinyl acetate (PVA) emulsion developed by the Union Carbide Corporation under contract to the Department of the Army for eliminating dust in the service areas adjacent to forward-area expedient airstrips and heliports. Of more than 300 materials tested for this purpose, DCA-1295 sprayed over a fiberglass scrim proved to be the most effective.[1] The DCA-1295 is supplied as a liquid concentrate and is normally diluted three parts of concentrate to one part of water at the time of application. The area where dust is to be controlled is cleared of vegetation, large rocks, and other debris, and the PVA-fiberglass surface is applied over the area with a Liquid Distributor for Dust Control. In a one-pass operation this machine wets the ground surface with water, unrolls the fiberglass scrim, and oversprays it with the diluted DCA-1295. As the DCA-1295 cures, it envelops the fiberglass scrim and bonds to the soil surface.[2-6]

2. Design life of the film is 6 months, but satisfactory performance has been achieved for longer periods. The film has been tested and proven at Eglin AFB, Florida;[2] Yuma Proving Ground, Arizona;[3] Aberdeen Proving Ground, Maryland;[4] Dyess AFB, Texas;[5] Fort Knox, Kentucky;[5] and the Panama Canal Zone.[6] Recently at the U. S. Army Engineer Waterways Experiment Station (WES), this system withstood jet engine blasts that produced wind velocities up to 125 mph.*[7]

3. Unfortunately, the DCA-1295 emulsion dries to form a glossy film that is highly reflective and therefore highly susceptible to enemy surveillance and target-seeking missile guidance systems. In

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* A table of factors for converting U. S. customary units of measurement to metric (SI) units and metric (SI) units to U. S. customary units is given on page 4.

addition, pilots have complained that reflections from the film sometimes make safe operation of their aircraft extremely difficult. An obvious solution to these problems would be to texturize and/or color the surface to reduce the reflection and color contrast.

Objectives

4. The primary objective of the research reported herein was to develop an effective means of camouflaging the fiberglass-reinforced DCA-1295 dust-control film on expedient airstrips and heliports and their related service areas. It was, however, considered that if the film could be adequately camouflaged by incorporating a colored texturizing material directly into the PVA emulsion before it was spread, then it could also offer possibilities for use as a spray coating for camouflaging various other materials and structures such as landing mats and various components of permanent installations. Investigating this latter possibility was a secondary objective.

Methods and materials

5. Three different methods were tried for applying the coloring and texturing agents to the DCA-1295 film in laboratory test molds:

- a. Blending the agent into the DCA-1295 liquid prior to application of the liquid to the fiberglass scrim.
- b. Dusting the agent onto the finished, but uncured, DCA-1295 surface.
- c. Painting the agent (mixed with a liquid carrier when necessary) onto the cured DCA-1295 surface. This method was also used in field tests.

6. One other method that was tried, and immediately found to be inappropriate, was to dye the fiberglass scrim before applying the DCA-1295 in the usual (standard) field sequence described in paragraph 1. For this test the scrim was dyed with black printer's ink, and although the visual color of the finished surface was notably darker than that with the normal white scrim, it was immediately apparent that the gloss would not be reduced as long as the coloring material was embedded beneath a clear smooth dressing of the DCA-1295. This method was, therefore, not pursued beyond this initial trial.

7. The coloring and texturing agents that were tested are

tabulated below according to the method of application, a, b, or c above. For the laboratory tests Teflon-treated round pie tins (diameter 6-1/2 in.) or aluminum laboratory trays (5 by 7 in.) coated with a commercial aerosol vegetable oil (Pam) were used as test molds. The fiberglass scrim was not included in these molds since weathering and trafficability were not to be considered, although effect of the treatment on strength of the DCA-1295 film itself was to be noted. For the field tests, the selected formulations were prepared and painted in test patches on pre-existing test beds as will be described later.

Agent*	Application Method**		
	a, Blend	b, Uncured	c, Cured
Paint extenders			
Kaolin powder	X	X	(X)
Calcium carbonate dust	X	X	(X)
Paint flatteners			
Celite 499	X	--	(X)
Nytal 400	X	--	(X)
Dry pigments			
Chalk dust (various colors)	(X)	X	X
Liquid pigments			
Latex paints	(X)	--	X
Printer's ink	(X)	--	--
Dye	(X)	--	--
Native soil	--	X	--
Floc	--	X	--
Metal filings	--	X	--
Fiberglass powder	--	X	--

* Some of these are commercial (trade-marked) products or formulations. See Glossary for further description.

** Tests shown in parentheses are not detailed in Tables 1 and 2 because early trials indicated the agents to be inappropriate for that method of application, or the early results were such as to suggest that the combination was not worthy of further consideration.

Design of Experiments

Laboratory tests

8. For the blending tests (method a), the test agent was mixed

directly with the DCA-1295 emulsion, as detailed in Table 1, then poured into the mold at the standard field application rate equivalent of 5 lb/yd^2.

9. For the other application methods (b and c), the standard DCA-1295 mixture of three parts of concentrate to one part of water was prepared and cast into the molds at the standard rate equivalent of 5 lb/yd^2, and then treated before curing (method b), or allowed to cure before treatment (method c). For method b (addition of texturing to the uncured surface), the texturing agent was simply sprinkled by hand onto the surface to a density that appeared at least sufficient to eliminate the gloss, and the excess was dumped off after the cast had cured. For method c (application of the test agent to the cured DCA-1295 surface), the formulation, as detailed in Table 2, was either brushed on the cured mold or poured on to simulate a spray application. The method of application is indicated in the remarks column in the table.

10. Many of the test agents, especially the dry powders, were found to require a dispersant or wetting agent for satisfactory mixing. For this purpose, one of two agents was used: (a) a commercial 10 percent detergent solution (Aerosol-OT), or (b) sodium phosphate tribasic (SPT) as soluble crystals. These are included, as applicable, in the formulation details in Tables 1 and 2.

11. For all tests, the finished, treated, and cured test specimen was visually compared with an untreated similar cast of the standard DCA-1295 mix. Judging criteria were gloss reduction, color, and other surface characteristics. In addition, subjective observations were made of the strength properties of the test cast, bonding of the test formulation to the DCA-1295 surface (method c), and other characteristics. (It was originally intended that the test casts would be subjected to standard tension tests, as prescribed by the American Society for Testing and Materials, but these tests were subsequently deemed unnecessary for a satisfactory conclusion to this test program.)

Field tests

12. Field test beds of DCA-1295 film were not prepared especially for this program. Two prepared areas were available, however, having

been previously placed at the WES for jet engine blast tests. These included a 5-lb/yd^2 DCA-1295 film on in situ clay soil, and a 7-lb/yd^2 DCA-1295 film on 6 in. of sand overlying in situ clay soil. Both beds had been laid by the standard method with fiberglass scrim reinforcement.

13. Of the 56 mixes that were tested in the laboratory, four of those that were judged to have given the most satisfactory results (all incorporating chalk dust) were selected for field application test (method c) on the two test beds. The test layout is illustrated in Figure 1. The four mixes to be tested were prepared in large quantities and applied on two patches, one by roller and one by sprayer (conventional gasoline-powered centrifugal pump), on each of the two test films. Flat latex paint (Table 2) was also applied by roller on four patches on each of the two test films. Each treated patch was subsequently judged for gloss reduction and color effectiveness, and was observed for effects of exposure to weather.

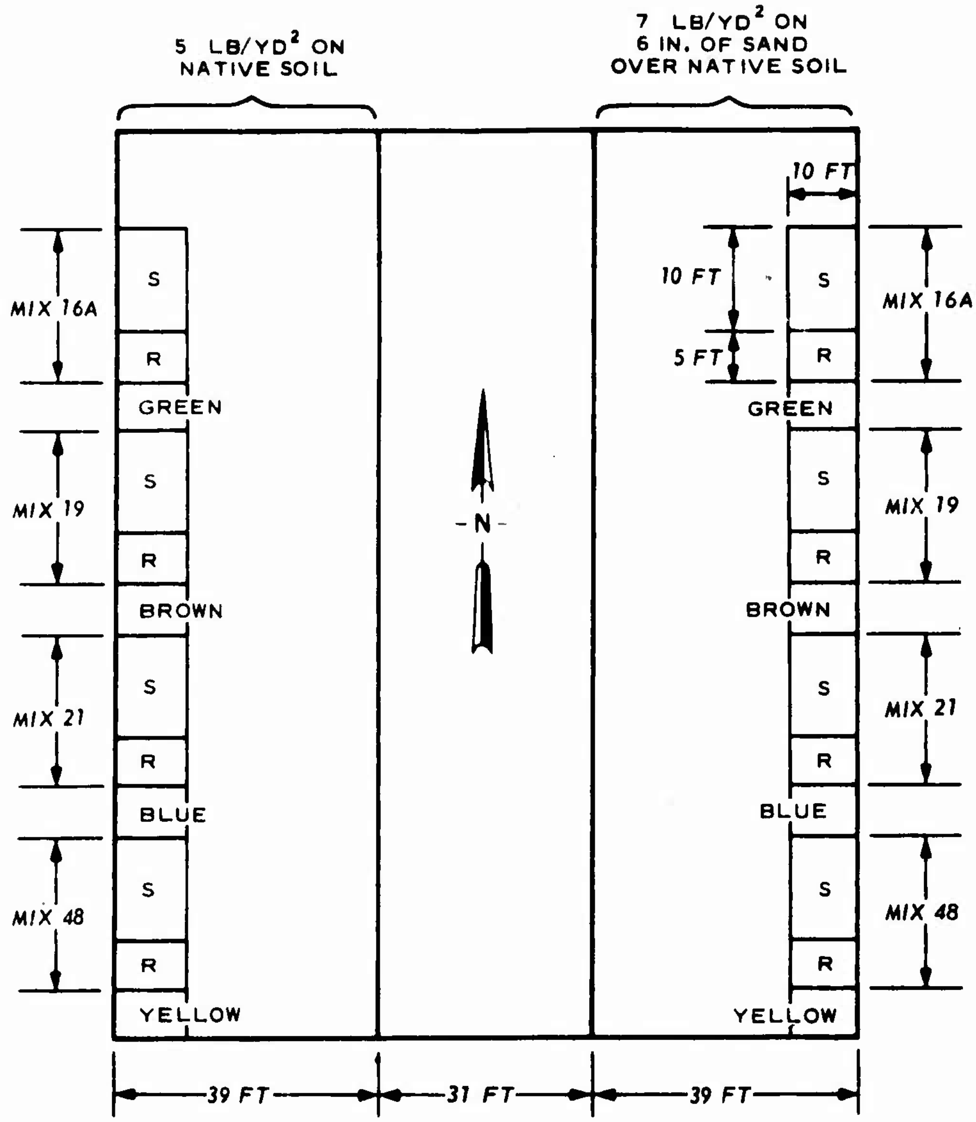
14. The same flat latex paint that was used in these tests was also brushed over landing mat and fabric membranes that had been previously coated with DCA-1295 and allowed to cure (secondary objective in paragraph 4), but the chalk-dust mixes of DCA-1295 were not applied to these surfaces.

Results

Laboratory tests

15. Results of the blending tests (method a) are shown in Table 1. In general, the results with this method were unsatisfactory. In the few cases where gloss was eliminated, the cured film was brittle and easily cracked or shattered. Usually, the gloss film was found to contain lumps or pockets of unmixed powder, and in some cases the powder settled to the bottom of the mold. The dispersants that were tried did not effectively disperse the powders in the DCA-1295 solution nor hold them in suspension. The commercial paint flatteners did not noticeably reduce the gloss on the cured film.

16. Texturing materials added to the in-place, but yet uncured,



NOTE: SEE TABLES 1 AND 2 FOR DESCRIPTION OF MIXES.

S INDICATES TEST PATCHES WITH COLORING FORMULA SPRAYED ON.

R INDICATES TEST PATCHES WITH COLORING FORMULA ROLLED ON.

COLOR NAMES INDICATE PATCHES PAINTED WITH FLAT LATEX, AS USED IN LABORATORY TESTS, TABLES 1 AND 2.

Figure 1. Layout for field tests of coloring and deglossing agents for DCA-1295 PVA dust-control film

DCA-1295 film (method b) usually reduced the gloss; however, placing these materials by hand was slow. Care was required because gloss was readily apparent in spots where coverage by the texturing agent was sparse. Clearly, this method would not be suitable for field application unless means could be devised for placing texturing material efficiently and uniformly over the relatively large areas to be covered. In addition, a potentially serious health hazard from inhalation of microparticles, particularly of such materials as felt or fiberglass, could exist in areas treated in this way. Such hazards would exist not only during application of the materials, but also continuously thereafter as a result of particles being dislodged by traffic and other activities.

17. In general, coating the cured DCA-1295 film with the test agents (method c) gave the most satisfactory results. The flat latex paints reduced gloss as well as any of the 56 mixes prepared in the laboratory; but of the 56, number 16A was judged the most satisfactory in all respects, including mixing ease, ease of application, and gloss reduction. Mix 19 was judged second best. Generally, it was found that the quantity of wetted agent (agent plus water dispersant, columns 3, 4, and 5, respectively, in Table 2) should slightly exceed the quantity of DCA-1295 in the mix. Otherwise, the coloring agent would settle in the painted or poured layer to leave a new glossy surface over the colored layer.

Field tests

18. With all four of the mixes tested in the field (Figure 1), spraying proved to be the fastest method of application, but produced a glossier finish than application by either rolling or brushing. Rolling, however, tended to leave "skips" where film dipped in conformance to ground surface irregularities. Best test results were achieved by a combination of rolling and brushing, but in an operational application, spraying and brushing would probably be the most efficient technique.

19. All four of the laboratory mixes tested in the field and the latex paint reduced gloss satisfactorily while simultaneously adding color. The test beds had been in place about 1 month prior to application of the gloss-reduction test agents in July 1974. At this writing

(June 1975), the laboratory mixes are still intact and show good camouflage effect, but the latex paint shows some checking and peeling. Thus, weathering ability of the chalk-dust mixes has exceeded the 6-month design life of the DCA-1295 film by at least 5 months and these mixes appear to be superior to the latex paint. These test films were not, however, subjected to traffic or jet engine blast tests after application of the camouflage mixes.

20. The latex paint adhered satisfactorily to the DCA-1295 coating on the landing mat and on the fabric membrane.

Conclusions and Recommendations

Conclusions

21. The following conclusions appear to be warranted:

<u>a</u>. Blending a gloss-reduction and/or a coloring agent into the DCA-1295 PVA emulsion before application to the fiberglass scrim (method <u>a</u>) in laboratory tests did not produce results that showed promise for effective field application of this technique. It may be assumed, however, that the tested agents have no chemical affinity for the DCA-1295 PVA, and it should not be concluded that this approach has been proven invalid.

<u>b</u>. Application of texturing material by sprinkling on the in-place, but uncured, film surface (method <u>b</u>) may produce better camouflage results than blending (method <u>a</u>), but hand spreading of the material is difficult and slow. Trafficability and weathering of the surfaces created by this technique were not tested, but if such tests demonstrate the surfaces to be acceptable with regard to these functions, it may be worthwhile to develop methods for operational applications. However, the potential health hazard from inhalation of airborne microparticles in treated areas should be carefully considered in selecting candidate materials for further experiments with this method. Native soils in particular would appear to be relatively free from this hazard, and in addition, would appear to offer excellent camouflage qualities.

<u>c</u>. One or more of the tested chalk-dust mixes can be applied to the in-place, cured DCA-1295 film (method <u>c</u>) with good camouflage effect that will weather well (in the test location climate) for at least the design life of the film. Mix 16A was judged best with regard to

gloss reduction and camouflage color, and mix 19 was judged second best.

d. The commercial latex paints applied to in-place, cured film (method c) weathered satisfactorily for at least the design life of the film, but did not weather as well as the laboratory chalk-dust mixes under identical test conditions. (This latex paint is presumably similar to standard camouflage paint.)

e. Comparison of the results of tests of latex paint and chalk-dust mixes applied to in-place, cured DCA-1295 film on soil with results of tests of latex paint applied to the DCA-1295 film on metal landing mat and fabric membrane suggests that good results should be expected with application of the chalk-dust mixes on these or other such surfaces of fixed-installation components.

Recommendations

22. It is recommended that:

a. Study of the camouflage effectiveness and applicability of the chalk-dust DCA-1295 mixes be continued, with emphasis on three aspects of the problem: (1) preparation and application time and cost of the coating in probable operational applications, including film installed on expedient airstrips (its design function), and if used for coating fixed-installation components; (2) trafficability and weathering of the coated surfaces under different kinds of uses (paved airstrips, roads, footpaths, communication towers) and different climatic regimes (desert, tropic, arctic); (3) the effect of the coating on electronic sensor signatures (infrared in particular) of expedient airstrips and various fixed-installation components in relation to background signatures.

b. Feasibility studies for using native soils for surfacing in-place, but uncured, DCA-1295 PVA film be continued on a limited basis, including the soil potential camouflage effectiveness and durability in both trafficked areas (airstrips, parking areas) and nontrafficked areas (roofs).

c. The specifications for DCA-1295 be made available to interested paint and chemical companies for research toward development of a chemically compatible additive for the DCA-1295 liquid that will cause it to cure gloss-free and in camouflage colors when used in the initial installation according to the prescribed one-pass method.

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Table 1

Formulations for Admixture of Coloring and Deglossing Agents with DCA-1295 PVA Emulsion (Application Method A) with Test Results
(See Glossary for description or definition of agents, Column 2; for explanation of other column headings, see notes at end of table)

Mix No. 1	Agent Name or Description 2	Formulation, Weights of Substances, g: Agent 3	Water 4	Dispersant: Aero 5	SPT 6	DCA-1295: Concentrate 7	Dilute 8	Color of Cured Specimen 9	Cured Specimen Rating 10	Remarks 11
1	Kaolin	5.0					20.0	Cream	P	Foamy (entrained bubbles), rough-textured, slightly glossy
1A	Kaolin	5.0		0.3			20.0	Cream	P	Same as mix No. 1, except glossier
2	Kaolin	5.0	10.0	0.3			20.0	Cream	P	Clay settled out, very glossy
4	Kaolin	5.0	5.0	0.3			5.0	Cream	G	Dull surface, stiff mixture
3	Calcium carbonate	5.0	5.0	0.3			5.0	Clear to dull white	F	Shiny white in depressions
17	Celite 499	5.0	23.5			4.0		White	P	Shiny surface, Celite 499 settled out
50	Celite 499	5.0	27.0			5.0		White	P	Mixed in electric mixer, film glossy, Celite settled out
22	Celite 499	1.0	10.0	0.2		4.0		White	--	Mixed easily, no gloss reduction
20	Celite 499	2.0	66.5	1.5		4.0		White	P	Celite settled out, film surface dull to glossy
18	Celite 499	0.8				74.0		Clear	P	Lumpy mix, glossy surface
28	Celite 499	5.9				74.0		White	--	Large proportion of Celite settled out, surface slightly glossy
23	Celite 499	3.0					75.0	White	--	Little or no gloss reduction
24	Celite 499	3.0	13.0				75.0	White	--	Little or no gloss reduction
25	Celite 499	3.0		0.1			75.0	White	--	Little or no gloss reduction
51	Celite 499	2.0			1.0		0.5	Clear	F	Mixed electrically, good dispersion. Strong film, but glossy surface
26	Nytal 400	3.0					75.0	White	--	Little or no gloss reduction
27	Nytal 400	6.0					75.0	White	--	Little or no gloss reduction

Explanation of Tables 1 and 2

Mix No. (Column 1) refers to the formulation as assigned for laboratory records. An asterisk (*) indicates a mix that was selected for the field tests.

Formulation (Columns 3-8) defines the specific formulation of the test mix identified in Column 1. Table values are weights of ingredients, in grams.

Dispersant (Columns 5 and 6) if any, is either Aerosol or SPT as defined in Glossary.

DCA-1295 (Columns 7 and 8) refers to the manner of introducing the agent formulation to the DCA-1295. Concentrate (Column 7) refers to undiluted DCA-1295 liquid concentrate; Dilute (Column 8) refers to the standard dilution of three parts concentrate to one part water.

Cured Specimen Rating (Column 10) is a subjective rating of the overall quality of the tested formula, including gloss reduction, surface bonding, and strength of the cured film, rated Poor, Fair, or Good.

Table 2

Formulations for Surface Application of Coloring and Deglossing Agents to DCA-1295 PVA Film (Application Method c), with Test Results
(See Glossary for description or definition of agents, Column 2; for explanation of other column headings, see notes at end of Table 1)

Mix No. 1	Agent Name or Description 2	Formulation, Weight of Substances, g: Agent 3	Water 4	Dispersant: Aero 5	Dispersant: SPT 6	DCA-1295: Concentrate 7	DCA-1295: Dilute 8	Color of Cured Specimen 9	Cured Specimen Rating 10	Remarks 11
9A	Chalk dust red	4.0		0.8			74.0	Bright red	P	Poured on; glossy
12	red	4.5	10.5	0.1			5.0	Dark red	F	Poured on; slight gloss
6A	red	5.0	2.0				5.0	Dark red	P	Poured on; brittle, cracked easily
6	red	5.0	5.0	0.3			5.0	Dark red	F	Poured on; did not flow well
5	blue	5.0	5.0	0.3			5.0	Dark blue	G	Poured on; dull smooth surface
7	red, blue (2:3)	5.0	5.0	0.3			5.0	Reddish brown	P	Poured on; did not flow well
8	red	5.0	6.5	0.3			5.0	Red	G	Poured on; dull surface, good flexibility
10	yellow	5.0	7.0	0.3			5.0	Bright yellow	G	Poured on; dull surface, strong pliable film, good bond
11	blue, yellow (1:1)	5.0	7.0	0.3			5.0	Avocado green	G	Poured on; dull surface, strong pliable film, good bond
19*	red, blue, yellow (3:5:22)	3.0	15.0	0.5		2.0		Tan	G	(None)
19B	blue	4.0	18.5	1.0		55.5		Bright blue	P	Poured on; glossy
13	red	5.0	10.0	0.1		5.0		Dark red	F	Poured on; slight gloss
14	red, yellow (1:1)	5.0	10.0	0.1		5.0		Dark orange	F	Poured on; slight gloss
15	red	5.0	11.0	0.1		4.0		Red	G	Poured on; dull surface, strong flexible film, good bond
16	tan (red, blue, yellow; 5:9:36)	5.0	11.0	0.50		4.0		Tan	G	Poured on; thorough mixing required, good film
16A*	tan (mix 16)	5.0	11.0	1.0		4.0		Tan	G	Poured on; mixing is important, good film
21*	tan (mix 16)	5.0	25.0	1.0		4.0		Tan	G	Poured on; mixing is important
21A	red, blue, yellow (8:2:1)	16.5	82.5	3.0		13.0		Bright tan	--	Poured on; glossier than mix 21
31	red	5.0	25.0	1.0		4.0		Dark red	G-F	Brushed on; excellent bond, dull finish with few shiny spots
30	yellow	5.0	25.0	1.0		4.0		Bright yellow	G	Brushed on; excellent bond, dull finish with few shrinkage cracks
29	blue	5.0	25.0	1.0		4.0		Blue	G	Brushed on; excellent bond, dull finish
32	tan (mix 16)	5.0	25.0	1.0		4.0		Dull tan	P	Brushed on; dull finish with many shrinkage cracks
42	yellow	5.0	25.0		5.0	4.0		Bright yellow	P	Brushed on; white crystals formed on film surface
43	tan (mix 16)	5.0	25.0		5.0	4.0		Tan	P	Same as 42 above

(Continued)

Table 2 (Concluded)

Mix No. 1	Agent Name or Description 2	Formulation, Weight of Substances, g: Agent 3	Water 4	Dispersant: Aero 5	Dispersant: SPT 6	DCA-1295: Concentrate 7	DCA-1295: Dilute 8	Color of Cured Specimen 9	Cured Specimen Rating 10	Remarks 11
	Chalk dust (Continued)									
44	yellow	5.0	25.0		1.0	4.0		Bright yellow	G	Brushed on; dull finish, tough film, good bond
									G-F	Poured on; dull finish, but with shrinkage cracks and glossy spots
45	tan (mix 16)	5.0	25.0		1.0	4.0		Dark tan	G	Brushed on; dull finish, tough film, good bond
									P	Poured on; glossy finish with few shrinkage cracks
46	tan (mix 16)	5.0	25.0		0.5	4.0		Tan	G	Brushed on; dull finish, tough film, good bond
									G-F	Poured on; dull finish, few shrinkage cracks
41	yellow	5.0	25.0		0.5	6.5		Bright yellow	G-F	Brushed on; dull finish, few shiny spots, no cracking, tough film, good bond
49	green	6.0	8.0			5.0		Green	F-P	Brushed on; dull finish, shrinkage cracks, tough film, poor bond, a dispersing agent needed
48*	tan (mix 32)	6.0	8.0		0.4	5.0		Tan	G	Brushed on; dull finish, good bond
									G	Poured on; dull finish, good bond
47	tan (mix 32)	6.0	4.0		0.3	4.5		Tan	G	Brushed on; good tough film, no cracking
									G	Poured on; thicker film than brushed; mixture judged too thick to spray
	Flat latex paint									
35	0503 yellow		Brushed on cured film removed from mold					Bright yellow	F-P	Brush streaked
34	0865 green		Brushed on cured film removed from mold					Light green	F-P	Brush streaked
33	0761 blue		Brushed on cured film removed from mold					Bright blue	G	Good bond and good film, but edges curled
36	0611 brown		Brushed on cured film removed from mold					Dark brown	--	Same as 33 above
39	0503 yellow		Brushed on cured film with edges fixed						--	Good bond, good film, no curling of edges, shrinkage cracks developed
38	0865 green		Brushed on cured film with edges fixed							Same as 39 above
37	0761 blue		Brushed on cured film with edges fixed							Same as 39 above
40	0611 brown		Brushed on cured film with edges fixed							Same as 39 above

Appendix A: Glossary

Note 1. Commercial products and formulations used in these tests were selected on the basis of convenience and local availability, to represent classes of substances that were thought might achieve the desired result. Citation of trade names for such products is for descriptive purposes only and does not constitute endorsement.

Note 2. Underlines indicate cross-referenced terms.

Aerosol - as used here, refers to a trade-named, 10 percent detergent formulation (Aerosol-OT) obtained from Fisher Scientific Co., Houston, Tex.

calcium carbonate - lime, or limestone dust (see also whiting). For these tests, a commercial product (brand name unidentified) commonly used for soil stabilization was used.

Celite 499 - trade name for a white diatomite powder formulation used as a paint flattener. (Johns-Manville Co., Atlanta, Ga.)

chalk dust - for these tests, a brand name (Strait-Line) of powdered marking chalk was used.

chopped fiberglass - fiberglass fibers about 2-4 in. long, used as reinforcement in concrete, PVA, etc. That used in these tests was produced by Ferro Corporation, Nashville, Tenn.

dispersant - a substance, generally also a wetting agent, used to assist in the mixing of a dry powder with a liquid. The dispersant separates the powder particles and assists in holding them in suspension.

dye - for these tests, commercial formulation (brand name Rit) was used.

extender - a substance mixed into paint to increase (i.e. "extend") the coverage per unit of volume. Many extenders are also flatteners, or vice versa.

fiberglass, chopped - (see chopped fiberglass)

flattener - any substance used in paint formulations to reduce the glossiness of the cured paint surface.

floc - a fine particulate substance used for adding texture to surfaces; specifically for these tests, a felt powder purchased from the local Sherwin-Williams paint store.

kaolin - white or pink clay of low plasticity, used as a paint extender.

latex paint - commercial formulation of exterior flat latex paint, purchased locally from Sears-Roebuck, Inc. Numbers in Tables 1 and 2 identify Sears-Roebuck pigment formulations or stock numbers.

metal filings - mixed filings, predominately steel, iron, aluminum, and copper, obtained from the WES Machine Shop.

native soil - soil from somewhere in the vicinity of the test or construction site. In the area where the tests were conducted, the native soil is loess or loessial clay (predominately silt- to clay-sized particles).

Nytal 400 - trade name for a hydrous magnesium silicate formulation used as a paint flattener (R. T. Vanderbilt Co., Inc., New York, N. Y.).

printer's ink - an unidentified brand name formulation obtained from the Wes Printing Branch.

SPT - trade name for a crystalline sodium phosphate tribasic formulation used as a wetting agent and dispersant (Fisher Scientific Co., Houston, Tex.).

wetting agent - a substance mixed with water to reduce surface tension. See also dispersant.

whiting - calcium carbonate (limestone) dust, used as a paint extender.

In accordance with ER 70-2-3, paragraph 6c(1)(b), dated 15 February 1973, a facsimile catalog card in Library of Congress format is reproduced below.

Styron, Clarence Radcliffe

Preliminary tests of gloss-reduction and coloring agents for camouflage of polyvinyl acetate dust-control film, by Clarence R. Styron III and Eugene E. Addor. Vicksburg, U. S. Army Engineer Waterways Experiment Station, 1976.

1 v. (various pagings) illus. 27 cm. (U. S. Waterways Experiment Station. Miscellaneous paper M-76-1)

Prepared for Office, Chief of Engineers, U. S. Army, Washington, D. C., under Project 1A762719AT40, Task A3, Work Unit 1006.

Includes bibliography.

1. Camouflage. 2. Coloring agents. 3. Dust control. 4. Gloss reduction. 5. Polyvinyl acetate. I. Addor, Eugene E., joint author. II. U. S. Army. Corps of Engineers. (Series: U. S. Waterways Experiment Station, Vicksburg, Miss. Miscellaneous paper M-76-1)

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